

X-671-65-66

NASA TM X-55174

SWEDEN OPERATIONS - 1962

GPO PRICE \$ _____

OTS PRICE(S) \$ _____

Hard copy (HC) 3.00

Microfiche (MF) .75

BY
C. B. TACKETT

N65-18958

(ACCESSION NUMBER)

(THRU)

(PAGES)

(CODE)

(NASA CR OR TMX OR AD NUMBER)

(CATEGORY)

FEBRUARY 1965

NASA

GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND

X-671-65-66

"Sweden Operations - 1962"

by C. D. Tackett

ABSTRACT

This report covers the work for the 1962 rocket firing in Sweden of the Sounding Rocket Instrumentation Section and is concerned chiefly with the problems, successes, and failures involved in telemetry instrumentation. Investigations of noctilucent cloud phenomena through the use of sounding rocket techniques in a foreign country are discussed in this report. The report presents the personal and technical experiences arising from the Sweden Operation, with the objectives of recording the information for future reference, study and evaluation, and training of personnel for future ventures in Sweden.

Author →

SWEDEN OPERATIONS - 1962

By

C. D. Tackett

**National Aeronautics and Space Administration
Goddard Space Flight Center**

SUMMARY

18958

An investigation of noctilucent cloud phenomena through the use of sounding rocket techniques in a foreign country --Sweden-- requires careful planning and ingenuity in solving field problems. This report presents the personal and technical experiences arising from the Sweden Operation, with the objectives of recording the information for future reference, study and evaluation, and training of personnel to embark on future ventures in Sweden. The document will serve as an instrument for improvement of the of the telemetering and instrumentation functions, in line with the general NASA philosophy of continuous improvement and development of both personnel and equipment.

One major reason for the study of noctilucent clouds is that a knowledge of inner space is prerequisite to the development of space craft for the near-earth and far regions of space. The precision and validity of the information derived from the studies of inner space are dependent, in a large measure, upon the sounding rocket programs.

This report covers the work for the 1962 rocket firing in Sweden of the Sounding Rocket Instrumentation Section and is concerned chiefly with the problems, successes, and failures involved in telemetry instrumentation. It should also be noted that a mobile telemetry ground station was specially instrumented with equipment that operated on 50 cps as well as 60 cps to meet Swedish power requirements. Such an operation requires the coordination of efforts on-site, in distant lands--in this case Sweden--with the personnel of NASA/GSFC and Swedish representatives.



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INTRODUCTION

In the summer of 1962, a series of four Nike Cajun rockets, designated K62-1, K62-3 through K62-5, and one Arcas, designated K62-2, were fired from a Swedish rocket range at Kronogard, Sweden. These launchings had the following objectives:

1. The direct sampling of noctilucent clouds* for Laboratory examination (accomplished by firing rockets through the cloud altitude, 82 km (51 statute miles), at times when the clouds were visible and again when they were not).
2. The direct measurement of energy and flux of electrons during an aurora event using a spherical type electrostatic analyzer (cosmic ray experiment). (This data was telemetered to the ground station, which was provided by GSFC's Sounding Rocket Instrumentation Section.)
3. Exposing blocks of emulsion for the detection and measurement of galactic cosmic radiation and low energy protons.

The cosmic ray experiment (control sample) can be accomplished during an aurora event (absence of noctilucent clouds). Similarly, the noctilucent clouds experiment can be conducted in the absence of an aurora event. For this reason, two separate sampling surfaces.

MEMO OF UNDERSTANDING

On 2 May 1962, Messers H. L. Dryden, representing NASA Headquarters and L. Hulthen, representing the Swedish Committee on Space Research, signed a joint Memorandum of Understanding, which is as follows:

"The U.S. National Aeronautics and Space Administration and the Swedish Committee on Space Research affirm a desire to continue cooperation in space research of mutual interest for peaceful scientific purposes.

The occurrence of noctilucent clouds is of specific interest and has been under study by Swedish scientists using ground instrumentation. In 1961, NASA and the Swedish Committee agreed to an extension of these studies using ARCAS sounding rockets.

* For further information on noctilucent clouds, refer to the June 1963 issue of American Scientific magazine, authored by Robert K. Soberman, page 510.

The two organizations agree that a sounding rocket experiment designed to sample noctilucent clouds directly constitutes a useful next step in these investigations. To advance such an experiment, each organization will use its best efforts as follows:

(1) The U.S. experimenters, under NASA sponsorship, will be responsible for providing four scientific payloads and payload check-out equipment.

(2) NASA will make available four Nike-Cajun scientific sounding rockets, an appropriate launcher, and the necessary telemetry equipment and ground antennas.

(3) NASA will make available training in the U.S. for Swedish scientists and technicians associated with the project, and will make available in Sweden appropriate U.S. advisory personnel.

(4) The Committee will provide: supplementary payload instrumentation to extend the range of sampling and to measure energetic particles; portions of the noctilucent cloud sampling instrumentation; launching pad; buildings for control, assembly and testing of rockets and payload; and suitable housing for the telemetry equipment. The Committee will further provide electrical power, ground communications, wind measurements, optical tracking, riometer data, cloud photography, a recovery team and SARAH receivers.

(5) The Committee will make available appropriate personnel for the above functions, as well as the aforementioned personnel for training at NASA.

(6) Each organization will appoint a Project Manager to assure proper coordination with the other.

(7) Both organizations will exchange technical information and technical visits as necessary.

It is planned that the experiment will be conducted in Sweden in the late summer of 1962.

No exchange of funds between the two agencies is contemplated.

The Swedish and American experimenters will jointly publish the results of the experiments and such results will be made freely available to the world scientific community through normal channels."

(signed)

Hugh L. Dryden
For the National Aeronautics
and Space Administration

(signed)

L. Hulthen
For the Swedish Committee
on Space Research

RESPONSIBILITIES

Air Force Cambridge Research Laboratory (AFCRL) supplied at least one cargo plane, eleven engineers and technicians, and four rocket payloads.

GSFC's Sounding Rocket Branch supplied four Nike Cajun vehicles and associated launcher equipment. GSFC's Sounding Rocket Instrumentation Section supplied a payload engineer (C. D. Tackett), a payload technician (R. Anstine), an FM/FM mobile telemetry ground station, and personnel for training and advice in handling and operation of the ground station and associated equipment.

PERSONNEL

A directory is provided, of personnel directly concerned with the Swedish operation. The directory is divided into three groups, NASA personnel, AFCRL personnel, and Swedish personnel. Swedish launch facility personnel are categorized by job function in the organizational chart shown in Figure 1.

NASA, GODDARD SPACE FLIGHT CENTER

Anstine, Robert, Sounding Rocket Instrumentation Section

Beard, C., International Programs Office

Nordberg, W., Physics Branch of the Aeronomy and Meteorology Division

Smith, W., Project Manager, Physics Branch of the Aeronomy and Meteorology Division

Tackett, Charles D., Sounding Rocket Instrumentation Section

AIR FORCE CAMBRIDGE RESEARCH LABORATORY

Chrest, Stanley

Gursky, Herbert (American Science and Engineering)

Hadley, William (American Science and Engineering)

Hemenway, Curt (Dudley Observatory)

McKenna, Edward

Patterson, M. (Pat)

Platt, James

Ryan, Thomas

Smart, Donald

Soberman, Robert

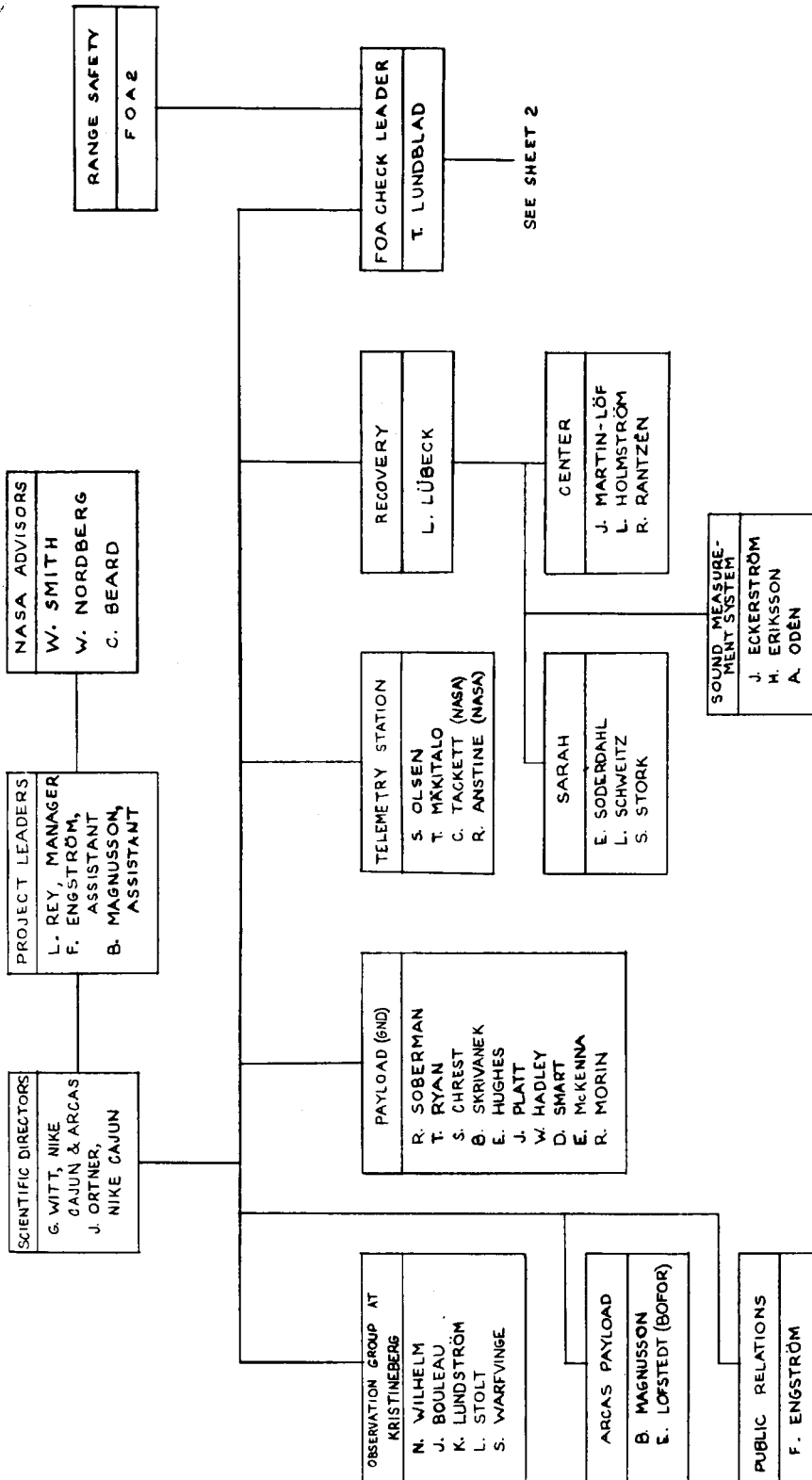


Figure 1. Project Organization Chart (Sheet 1 of 2)

FROM SHEET 1

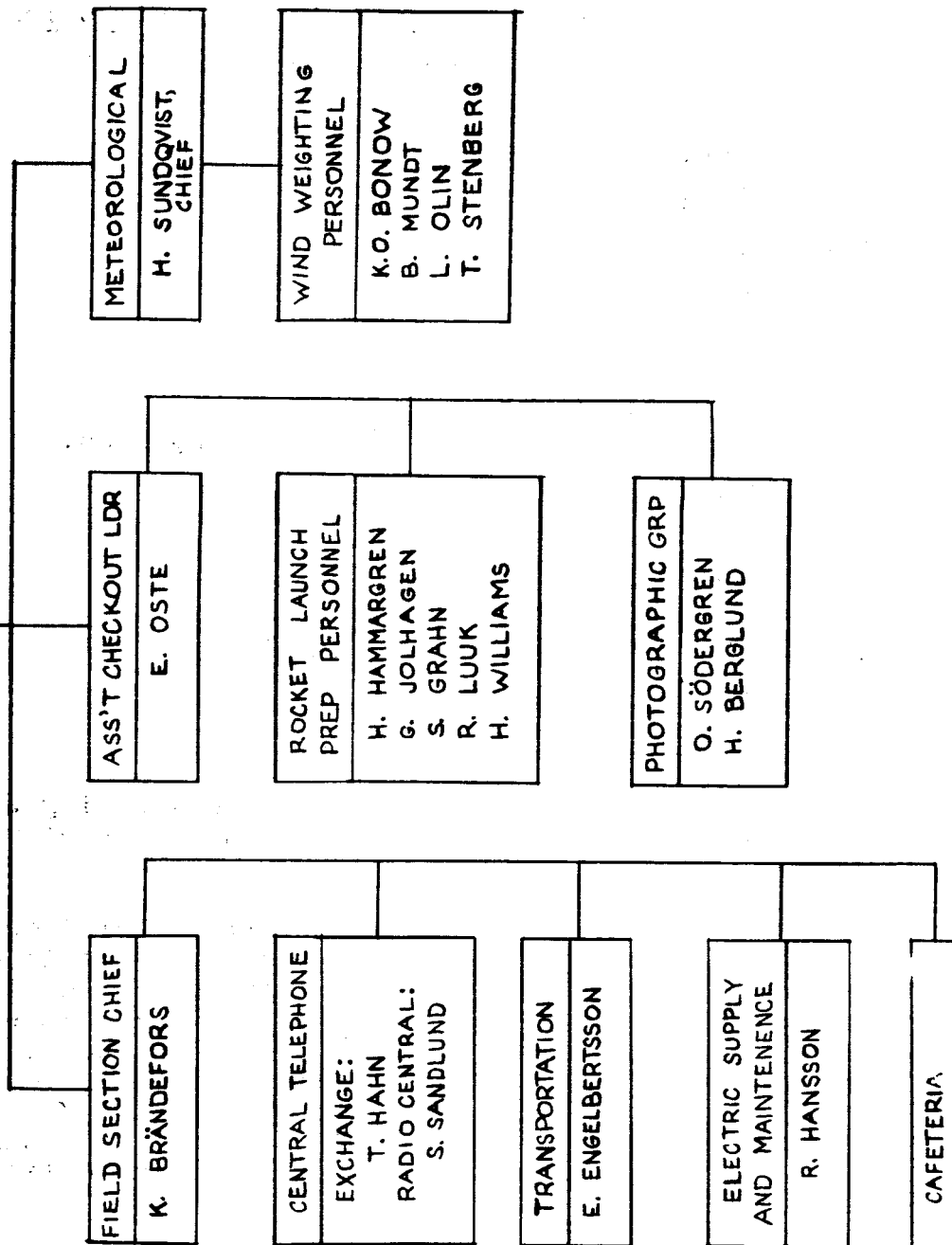


Figure 1. Project Organization Chart (Sheet 2 of 2)

SWEDEN

Committee on Space Research, Royal Institute of Technology

This group, located in Stockholm, Sweden, comprised:

Hulthen, Professor Lamak

Lubeck, Lennart

Rey, Lars, Project Manager

Soderahl, S.

Witt, George

Wilhelm, Nathan

Kiruna Geophysical Observatory

This group, located in Kiruna, Sweden, comprised:

Makitalo, Tagie

Olsen, Sven

Ortner, Johannes, Project Scientist

Research Institute of National Defense (FOA)

Lundblad, Tord

TRAINING OF SWEDISH PERSONNEL

In accordance with the Memorandum of Understanding between NASA and The Swedish Space Committee, Swedish personnel would be trained in FM/FM telemetry techniques at NASA/GSFC.

In April 1962, Sven Olsen and Tagie Makitalo arrived from the Kiruna Geophysical Observatory (KGO). These men were to operate and maintain the telemetry ground station in support of the Nike Cajun launchings in Sweden. Messers Olsen and Makitalo were assigned to Sounding Rocket Instrumentation Section where, for approximately five weeks, they were instructed in operation and maintainance of the FM/FM telemetry ground station. Mobile FM/FM Telemetry Ground Station E was designed, fabricated, instrumented in record time, and used as the on-site trailer supporting the Swedish launchings.

Messers Olsen and Makitalo arrived at GSFC with a basic understanding of telemetry techniques and it was only necessary to familiarize them with the actual, on-site equipment that they were to use. They grasped techniques readily and, at the end of five weeks, returned to Sweden. GSFC advisors assigned the task of instructing the Swedes were C. D. Tackett and B. F. Karmilowicz, both of Sounding Rocket Instrumentation Section.

MOBILE FM/FM TELEMETRY STATION E

Figure 2 shows the mobile FM/FM telemetry station which was assigned to support the Swedish launchings. A block diagram of Station E appears in Figure 3. In addition to the usual test equipment and spare parts (see the complete inventory list in Appendix A), the major equipment mounted in and on mobile station E consisted of: an 8-turn, 10-db gain, manual track, single-helix antenna; a 6-element, 8-db gain Yagi antenna with base plate; a 36-channel, magnetic, recording oscillograph, Model 5-119-P4-5, with its Datarite magazine, Model No. 5-036A; two 55-260 mcs, FM/FM Nems Clarke special purpose receivers, Model Nos. 1906 and 1501 respectively; an 18-channel, ultraviolet, magnetic, CEC recording oscillograph, Model 5-124; 6 subcarrier discriminators (EMR Model No. 167A-01) mounted in EMR rack adapter, Model RA-167a; an ASCOP Pre-amplifier power supply, Model No. APA-2PS and associated ASCOP preamplifier, Model No. APA-2; an Ampex, 7-channel, 1/4-inch tape transport, Model No. FR-1100; a magnetic tape de-gausser, Model No. SE-10; and a Collins 51J communications receiver, used for timing synchronization with WWV and/or local Swedish timing.

Prior to turning over the Ground Station to Swedish personnel, it was necessary to instruct them in a pre-launch checkout procedure. This procedure, followed for all launchings, and is as follows:

X -180 min Telemetry ground station crew reports, turns ground station ON and checks line voltage

X -135 min Begin station checks; clean tape heads; warm-up precessor

(1) Check firing clocks; check GMT

(2) Conduct receiver radiation on 225 mcs, using the Boonton signal generator, as follows:

<u>Receiver</u>	<u>Standard Reading</u>	<u>Present Deviation</u>
No. 1	200k uv (56 ma)	_____
No. 2	200k uv (29 ma)	_____

+125 kcs deviation for 5.0 volts peak-to-peak on both receivers

(3) Check timing counters

(4) Set the discriminators as follows:

<u>Disc</u>	<u>Channel</u>	<u>Filter</u>	<u>Output Dial</u>	<u>Transmitted Data</u>
1	40 kcC	1200 cps	3.06	Cosmic Ray Electrostatic Counter

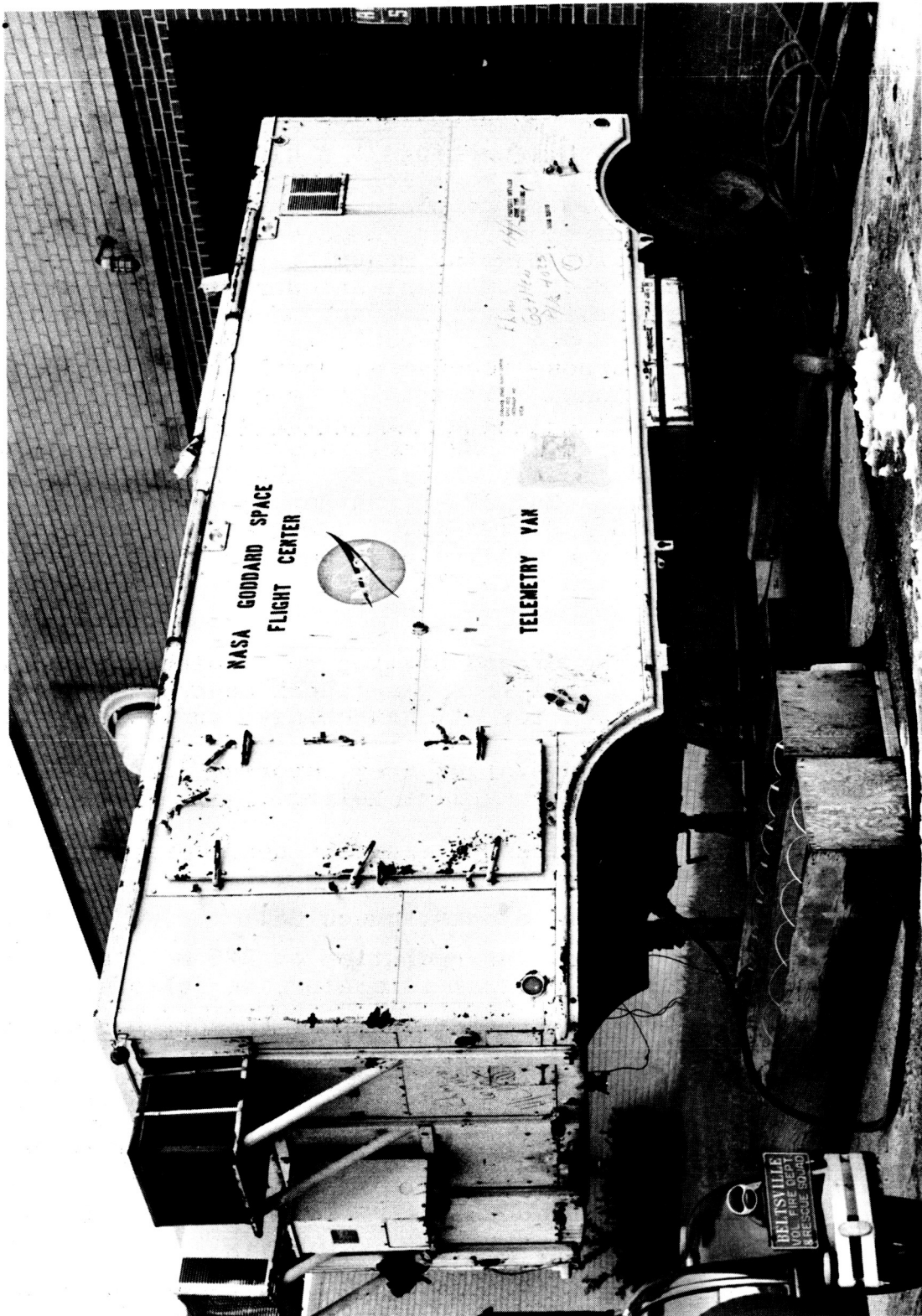


Figure 2. Mobile FM/FM Telemetry Ground Station

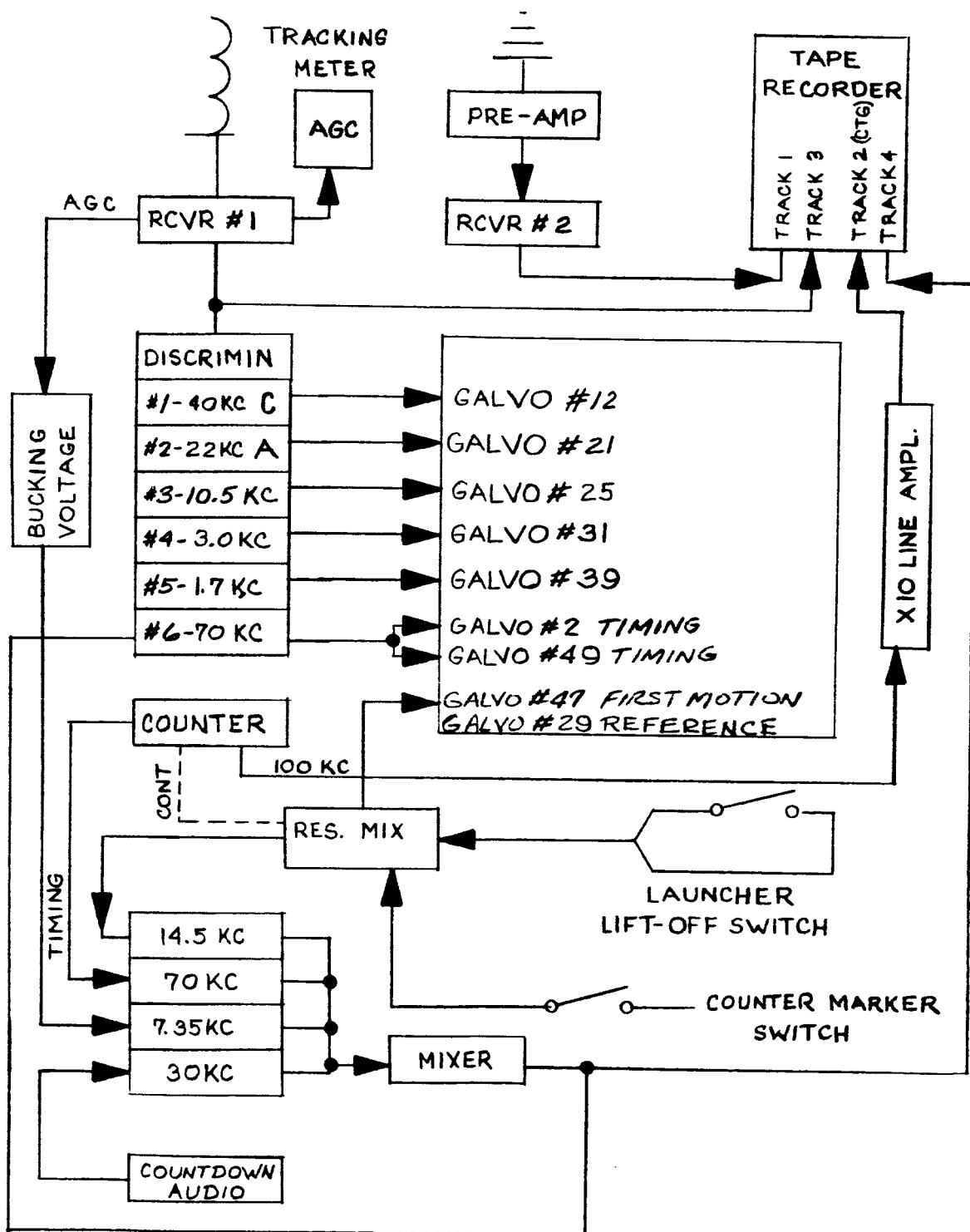


Figure 3. Mobile FM/FM Telemetry Ground Station E, Block Diagram

<u>Disc</u>	<u>Channel</u>	<u>Filter</u>	<u>Output Dial</u>	<u>Transmitted Data</u>
2	20 kcA	660 cps	3.30	Cosmic Ray Electrostatic Counter
3	10.5 kc	600 cps	3.16	Commutated (Cook recovery)
4	3.0 kc	45 cps	2.86	Accelerometer
5	1.7 kc	6 cps	2.80	Magnetometer
6	70 kc	1050 cps	min.	Ground Timing

(5) Check 36-channel recording oscillograph for the following:

- (a) Location of galvanometers (check with Maximum discriminator deflection)
- (b) Record Datarite calibration of discriminator (3 steps, low, center, and high)

(6) Check inputs to tape multiplex as follows:

30 kc 5.0 volts peak-to-peak maximum
70 kc time markers
14.5 kc first motion and test marker
7.35 kc AGC on dipole

(7) AGC - Calibrate 2, 5, 10, 20, and 30 microvolts. Set bucking voltage from output of receiver to tape input. Check tracking meter and intercom

(8) Set the 7-channel Ampex tape recorder as follows:

<u>Setting</u>	<u>Track 1</u>	<u>Track 2</u>	<u>Track 3</u>	<u>Track 4</u>
Bias level	80 mv	125 mv	90 mv	90 mv
60-cps servo level	-----	1.8 volts peak-to-peak at 87.5% mod.	-----	-----
100 kc input level	-----	7.0 volts peak-to-peak (± 0.5 volt)	-----	-----
CTG output level	-----	2.8 volts peak-to-peak	-----	-----
Multiplex level	-----	-----	-----	4.0 volts
Record level	8.5 mv	8.5 mv	8.5 mv	8.5 mv
Reproduce	5.0	to be measured	5.0	4.0

Data:

- Track 1 Receiver No. 2
- 2 CTG + 100 kc
- 3 Receiver No. 1
- 4 VCO multiplex

Check tape recorder by output of reproduce amplifier on each channel.

- X -105 min Finish checkout
- 90 min Payload telemetry to be switched to external power
- (a) Datarite on 1 ips (slow)

(b) Test tape ON and perform following checks:

<u>Frequency</u>	<u>Disc.</u>	<u>Input Level</u>	<u>Input Standard</u>	<u>Deviation</u>
40 kc C	1	-----	1.0	-----
22 kc A	2	-----	0.6	-----
14.5 kc	3	-----	0.2	-----
3.0 kc	4	-----	0.2	-----
1.7 kc	5	-----	0.3	-----
	6	-----	---	-----

- 88 min Datarite to 10 ips (fast)
- 85 min End of test; Payload and telemetry OFF; Datarite OFF; and tape OFF.
- 30 min Change to permanent magazine
- Calibrate: (1) 3-step calibrate (with counter)
- (2) each step 2-second duration
- Record both on Test tape and Ampex 7-channel recorder
- Calibrate AGC 5 step - 0, 2, 5, 10, 20, and 30 uv
- Upon completion, change to datarite and reproduce test tape, calibrate on datarite, and check counter (plus time).

- 10 min Telemetry transmitter on external and measure signal strength as follows:

<u>Receiver</u>	<u>Video</u>	<u>Sig. Strength Meter</u>	<u>Standard</u>	<u>Signal Strength</u>
1	---	-----	72 ma	-----
2	---	-----	32 mc	-----

- 8 min Test tape ON and datarite on 10 in./sec. Payload switch to "fly" (internal). Conduct final data checks on the discriminators prior to launch, as levels indicate in X -90 minute check.
- 6 min End of test; change to flight tape; change to permanent magazine; check light intensity of oscillograph recorder after change (8.0 volts on LOW)
- 2 min Telemetry to internal power
- 1 min Tape ON; monitor receiver no. 1 video through the reproduce amplifier; Payload switched to "fly" (internal).
- 30 sec Start recorder at 1 in./sec.
- 20 sec Switch recorder to 10 in./sec.
- 0 Fire

At end of flight - generate 7-step calibration on flight tape of discriminators.

PRE-SHOOT CONFERENCE

On 9 May 1962, Wendell S. Smith, the Project Manager, reviewed the facilities at the Kronogard Range and confirmed project scheduling and commitments.

KRONOGARD RANGE

"Cape" Kronogard, as the Kronogard Sounding Rocket Range is called by the Swedish press, was established to support sounding rocket launchings near the Arctic Circle. This Range will be used until the European Space Research Organization (ESRO) Range at Kiruna is completed.

Kronogard is located approximately 40 km (approximately 24 statute miles) south of the Arctic Circle. Kabdalis, the nearest town, is six miles from the Range. Most of the Swedish launch crew were housed at Kabdalis, whereas the American crew and the remainder of the Swedish crew stayed at Vidsel, which is 40 miles from the Range (see Figure 4).

The nearest commercial airport is located at Lulea, a costal city at the mouth of the Lule River, which flows into the Gulf of Bothnia. Distance from the Gulf to the Kronogard Range is approximately 100 miles.

Kronogard Range was constructed on a low-finance budget

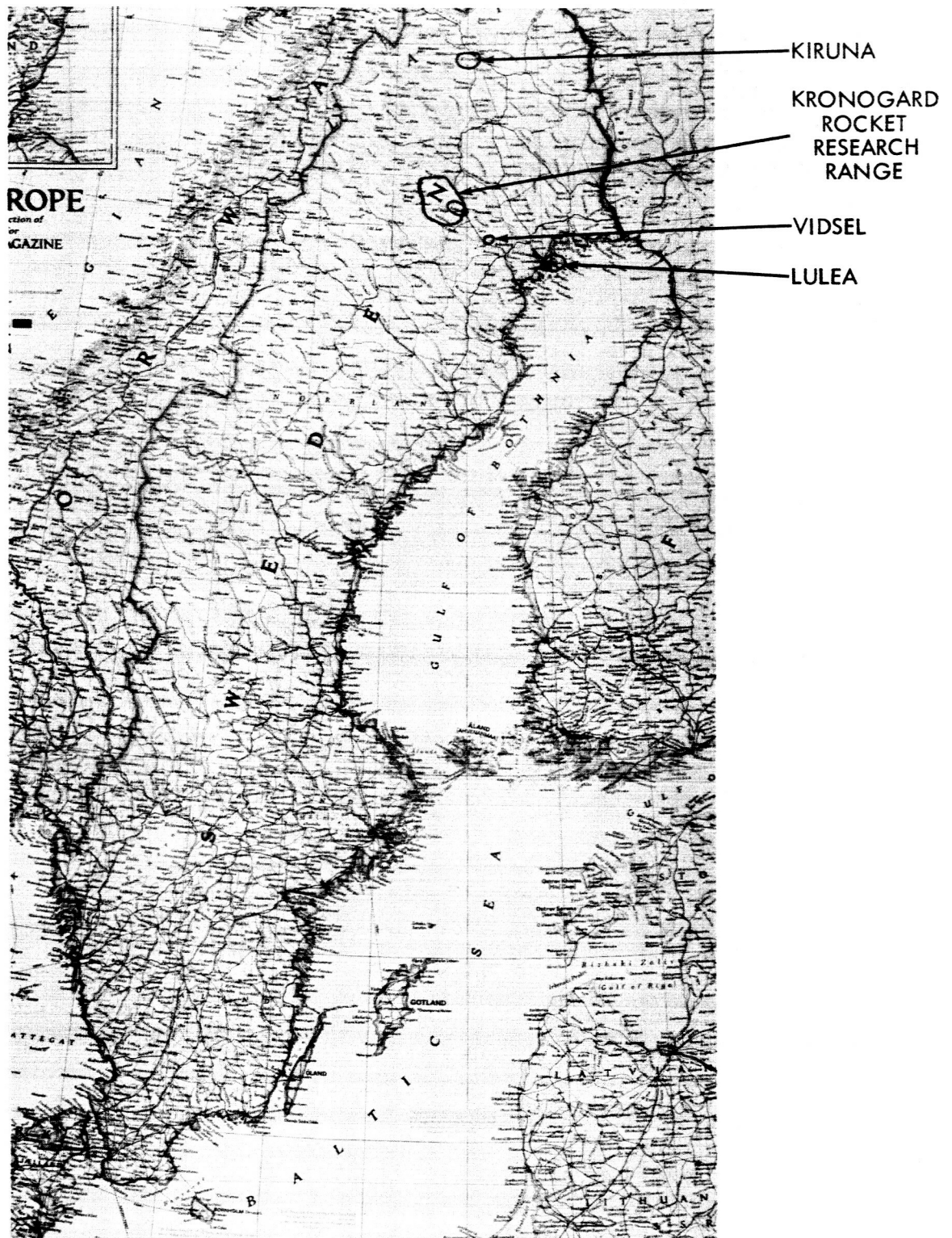


Figure 4. Map of Sweden

utilizing an abandoned farm, adjacent to a Swedish military range. Sounding rockets, launched at the Kronogard Range, impacted on the military range. In order to fulfill the payload recovery requirements, American personnel required access to the Swedish military range. Following a complicated security clearance translation, two AFCRL civilians were allowed on the military range to aid the Swedes in recovering the payloads.

The Kronogard Range was centered around the farmhouse, which included: control room for the payload and launching, meteorological room, communications center, and project offices. Payload build-up was conducted in a utility shed near the farmhouse. What once served as a chicken coop and pig barn now housed the SARAH recovery system and the rocket build-up area, respectively. (Figure 5 is a sketch layout of the Kronogard Range. Photographs of the Range, with self-explanatory captions, are shown at the end of the report, prior to appendices.)

A tent was provided with food and drink for lunches and between-meal breaks. It was operated by volunteer Swedish civilian personnel who were on duty every day and night during preparation and launchings.

PROJECT SCHEDULING

The following event schedule was followed:

<u>Date</u>	<u>Action</u>
3-9 June	AFCRL environmental checks
10-16 June	AFCRL telemetry checks
17-19 June	GSFC telemetry checks with AFCRL payloads
17-23 June	Pack all equipment for shipment to Sweden
25 June	Transport equipment to Sweden
2-8 July	First AFCRL personnel arrive at Kronogard Range
16 July	First NASA personnel arrive at Kronogard Range
2-26 July	Prepare rockets and hold equipment checks
26-27 July	Formal horizontal checks and practice countdown
30 July	Formal vertical checks
1 August	20-minute standby for launch

COMMITMENTS

The following commitments were re-affirmed in W. S. Smith's memorandum of 9 May 1962:

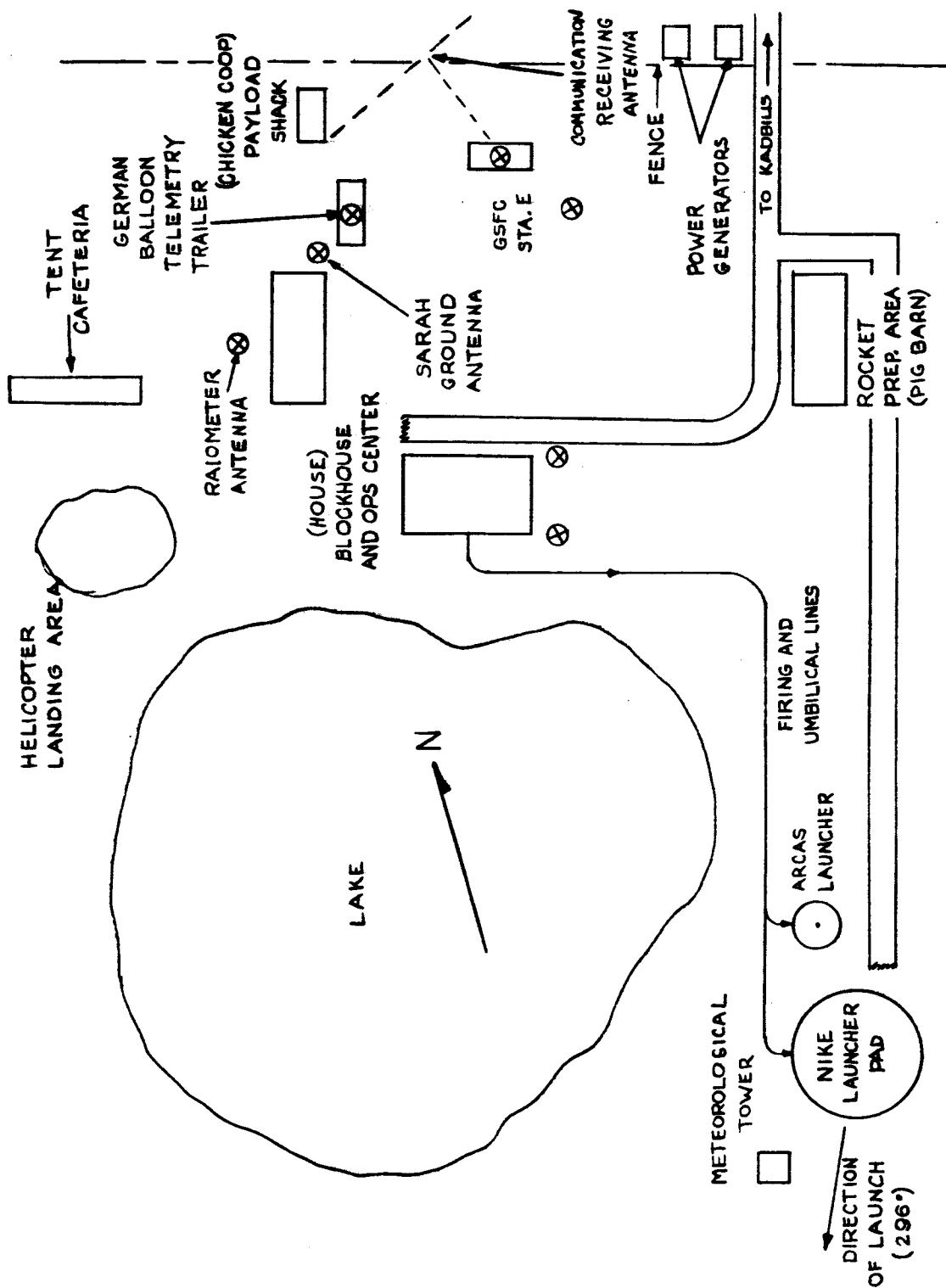


Figure 5. Kronogard Range Layout

1. The following will be supplied by Sweden:
 - a. Group of buildings for rocket assembly, payload assembly, telemetry receiving equipment, and control center.
 - b. Approximately 35 people for launch and recovery phase of the experiment.
 - c. All ground equipment to handle the rockets, including a dolly, transit to survey fins, and two scales to weigh and determine the rocket center of gravity.
 - d. A firing panel design.
 - e. Assembly of two grenade Nike-Cajun rockets in conjunction with Wallops Island personnel.
 - f. Cabling of 30 #8 wires (2.5 ohms round trip) from the control center to the launcher.
 - g. Recovery Helicopter
2. The following will be supplied by NASA:
 - a. Three ground SARAH receivers.
 - b. Airborne SARAH receiver for helicopter.
 - c. Chaff to aid radar acquisition.
 - d. Spin wedges.
 - e. Flares for Cajun fins.
 - f. Firing panel (Wallops Island).
 - g. Two Nike-Cajun rockets.
 - h. Diplomatic immunity for the sampling cans upon their return to the U.S. after the experiment. This is a very essential point as the cans must not be exposed at any point after the experiment.
 - i. Telemetry trailer (supplied by Sounding Rocket Instrumentation Section) and launcher.
3. The following will be supplied by the Air Force:
 - a. Environmental test of the payload design (rocket payloads, and associated equipment; i.e., everything for the experiment).
 - b. 11 payload project personnel.
 - c. C-124 cargo plane for transportation of all equipment and rockets to Sweden.

BOSTON CONFERENCE

AFCRL personnel indicated that an incompatibility might exist between the payloads and the telemetry trailer instrumentation. For this reason, the mobile ground station was taken to AFCRL Boston, Mass., followed by Messers Tackett and Anstine from Sounding Rocket Instrumentation Section. They arrived at AFCRL on 18 June 1962 to conduct the compatibility checks of the flight payloads and ground station equipment supplied by NASA. Compatibility checks were completed successfully on 20 June with only one minor problem, a failure of the CEC 5-124 oscillograph recorder's power supply. The failure was due to underrated diodes failing (power supply) which were replaced with only minor difficulty. Upon completion of the compatibility checks, the telemetry trailer was turned over to the Air Force for shipment to Sweden.

FINAL PREPARATIONS

The following are excerpts from a memorandum from W. C. Smith (NASA Project Manager) to his NASA supervisor, Dr. W. Nordberg, following Mr. Smith's visit to the Kronogard Range:

1. Equipment from the U.S. arrived at Lulea via two C-124 Globemaster cargo aircraft on 7 and 8 July. A cursory inspection of the boxes as they were off-loaded revealed no damage. Detailed inspection of the equipment was impossible due to their storage in a hanger in which foreign nationals were not allowed. All equipment was to be transported to the Range and unpacked by 16 July. Damage, if any, will be noted then.
2. At the Range, the concrete pad for the launcher is in, and the road to the launcher has been improved. Power lines from the generators to all buildings have been laid. Communications, consisting of a 40-pair switchboard and intercom, are being installed and should be operating by 16 July.
3. Present plans call for three recovery stations to be installed and operating by about 18 July. Calibrations and simulated recovery operations will begin as soon as the stations are operational. Computation tables will be prepared on the computer at Stockholm to aid each sound ranging station operator in determining the azimuth of the waves. TNT charges will be set off at unknown points within the recovery area. All recovery stations, as well as plot center, will plot the origin of the sound waves. Similar tests will be run with a light plane carrying a SARAH transmitter. The plot center and helicopter will use maps made up of recent aerial photographs of the area,

and these maps will employ a special, finer gridding system to more exactly pinpoint positions. Two chaff releases will occur during payload descent: one at separation and the other at parachute deployment. Available radar systems should be able to pick up both chaff releases.

4. One Arcas rocket will be launched with a payload similar to one used in 1961, but with improvements. Firing dates will be in early August, probably corresponding with a visit by the Swedish Space Committee, on or about 6 August.
5. Formal horizontal and vertical checks will begin about 25 July. Informal checks will take place as soon as the various functions are ready. A practice countdown, simulated launch, and recovery will take place during the period 25-29 July.
6. A frogman will be standing by in case of water impact in one of the lakes on the range.

TRIP REPORT

R. T. Anstine and C. D. Tackett, from GSFC's Sounding Rocket Instrumentation Section, departed for Kiruna, Sweden on 13 July, arriving on 15 July, following a stop-over in Stockholm. They were met at the Kiruna airport by Sven Olsen and Tagie Makitalo of KGO. The remainder of the day was taken up by a tour of the Observatory and a discussion of plans for the Range trip. Motel arrangements were made locally since accommodations normally available at the Observatory could not be obtained.

16 July 1962

The telemetry group left Kiruna for the Range, a drive of approximately 125 miles over dirt roads, arriving later that afternoon in Kronogard. A quick look at the telemetry van revealed that no serious damage had occurred during shipment. After the trailer inspection, the group drive to the motel at Vidsel (the name and telephone number is Vardshusset Renkronan, 200, respectively).

17 July 1962

Upon arrival, the telemetry group unpacked the trailer, connected power circuits to the Range power generators, and installed the communication antenna between the payload shack and a large tree. The eight-turn, helix, telemetry antenna was mounted on the van's roof, and the tracking meter and other lead-in cables also were connected. The fixed Yagi telemetry antenna was mounted on its stand and situated on the ground near the trailer. A fixed Yagi

was used due to space limitations and the non-availability of helix antennas. Field telephones were connected between the payload shack and the van. Prior to leaving, the trailer was made "ship shape" so that equipment checks could be conducted on the following day.

18 July 1962

On closer inspection, it was noted that the CEC 5-124 oscillograph recorder's blower was loose and had rotated in its mount. This caused the galvanometer light to overheat and burn out. The bulb was replaced and the fan adjusted. CEC 5-119 oscillograph recorder's optical system was cleaned and adjusted for proper alignment. One galvanometer (CEC Model No. 7-362) was found damaged and was replaced. Several cables were found loose and one broken on the Ampex FR-1100 tape recorder, all of which were repaired.

Difficulty was experienced with the Tektronix RM-16 oscilloscope, the cause being either an excessively high ambient temperature resulting from inadequate air circulation, or the result of 50 cps operation of a 60 cps transformer resulting in lower efficiency and overheating. It was necessary to open the trailer door, which was behind the equipment racks, and blow cool air on the equipment with a fan.

The Swedish crew requested assistance to install cables between the launcher and the blockhouse.

19 July 1962

It became evident that the Swedish project needed better organization, for example, Lars Rey (Swedish Project Manager) was unaware of the status of different groups in the project...information pertaining to the assembly of the rocket and launcher was not being passed from Tord Lundblad (chief of the rocket and launcher build-up) to the working level of the technicians. In addition, recovery operations were lagging behind schedule. It was, therefore, suggested by the NASA/AFCRL team that daily meetings be held between all group leaders to discuss any problems. This scheme was adopted and the first meeting was held at 1500. Initial discussions considered the issuance of badges and the meaning of the various designations. These designations were: red, payload crew; green, rocket crew; blue, telemetry crew; yellow, visitors with escort.

It was deemed necessary for the American recovery crew to have clearance into the Swedish military range. Clearance papers were translated into English and explained to the Project Scientist and his assistant, the two Americans scheduled for the recovery area.

An unexpected problem developed; the SARAH ground antennas had not arrived yet and there was some concern about their ability to support the antennas. It was decided to hold off any action until after the arrival of the antenna poles.

SARAH beacon airborne tests between a helicopter and the ground stations were scheduled for the next day (20 July). Mounting of the rocket and fin alignment were planned for 23 July, although this was considered an exceptional amount of work for an inexperienced crew. The sound ranging stations were scheduled for completion by 27 July. It was established that Tord Lundblad had the responsibility for range safety. Logistics group requested continuing assistance with cable installation. In addition, they requested information on the connection of the payload ground control at the blockhouse.

Another problem developed in the ground station with the CEC 5-124 oscillograph recorder. It developed a malfunction due to a shorted AG-1012 diode, which was replaced, making the recorder operational. This was the second time that this failure occurred. (First occurrence was in Boston on 20 June).

A countdown meeting was planned for the following day, 20 July.

20 July 1962

The first payload check was made through the telemetry ground station. During the tests, it was found that the battery voltage was too high for the electrostatic analysis. Adjustments were required to make the systems compatible. Ground station recordings were excellent.

At the daily meeting, it was agreed that the bus (for transportation from Vidsel to Kronogard) would leave Vidsel at 0800 on Saturday and, if necessary, on Sunday.

A successful check was made on the SARAH beacon airborne system. Limited ground tests will begin tomorrow, 21 July, with full scale tests to start Monday, when the antenna poles become available.

Completion of the sound ranging system was proceeding as scheduled and was expected to be finished on time.

When the Nike shipment was opened, it was discovered that the bolts were missing for the four Nike adapters. A search was begun to find the missing 24 bolts. It was reported that the range personnel had completed the fin installation on one Nike booster and that the second rocket operation had been started.

Meteorological work was proceeding on schedule; the anemometer was installed near the launcher and was ready for operation; weather balloon launchings were to start on Saturday, 21 July.

It was decided that the cafe would be open Saturday, but not Sunday.

21 July 1962

R. Anstine assisted the Swedish crew in installing the control cables between the blockhouse and the launcher.

23 July 1962

The telemetry van crew assisted the recovery crew in the checkout of the SARAH airborne system and two airborne units were checked out, as follows: a) No. 1 frequency = 243.20 at a pulse width of 5.4 microseconds and b) No. 2 frequency = 243.37 at a pulse width of 5.0 microseconds.

Frequency response of receiver No. 1 was checked prior to terminating work for the day.

24 July 1962

The day was spent setting up the Ampex FR-1100 tape recorder. Difficulties were experienced with the servo control loop and it was found that the D.C. power supply voltages were too low, due to the low line voltage (109-112 VAC.) Power supply voltages were reset, since the line voltage could not be increased. The 18-24-kcs filter, in the control track generator amplifier, did not operate properly, and it was decided to operate from the precision power supply (with 100 Kcs tape speed compensation).

25 July 1962

First horizontal checkout was held today. It was noted on the pre-horizontal bench check that there was clipping on the negative swing of the video. Payload personnel were not concerned about this. It was also noted that there was no pre-emphasis schedule set up for the telemetry system and this did not bother the AFCRL payload group. With the aforementioned exception, the horizontal test was satisfactory. During the tests, both telemetry ground antennas were pointed at the launcher.

26 July 1962

It was decided that a more accurate timing system would be needed other than the wrist watches being used. Since WWV had

been heard only twice since the station was set up, it was decided to borrow an electronic counter from Kiruna and manually sync this to the Swedish time count given at 1300 every day. In addition, it was requested that a lift-off pulse be incorporated on the telemetry records. This was done by connecting the BOOSTER LIFT switch to start the ground station counter and mixing the output into the tape recorder and galvanometer of the oscillograph recorder.

27 July 1962

Communications between payload control, countdown, and the telemetry van was still a problem. Range and telemetry van countdown procedure was reviewed and approved. A telemetry van for a German balloon launch was brought onto the range. It used a RF frequency of 150 mcs, and no interference problems were expected. The German van did not lower the line voltage enough to cause any problems with other Range equipments.

28 July 1962

A full scale vertical test, using the "hot" countdown (see Appendix B), was held unsuccessfully. Confusion was due primarily to the lack of good intercom communications. The telemetry van crew missed the 90-minute test and had to throw the "panic" switch until contact could be made with the payload control personnel. A decision was made to put a direct line between the payload control and the telemetry van. The audio countdown could not be recorded on the magnetic tape because the recording system loaded down the intercom. This problem was eventually overcome.

It was decided that the intercom system must be improved before attempting a launch. The countdown was to be given in both Swedish and English, and accentuated by tapping an empty wine bottle with a hunting knife.

Two series switches were installed in the rocket firing circuit. They provided better assurance that the count could be stopped if an emergency should develop during crucial stages of the countdown.

The telemetry ground station checkout went beyond the planned checkout time by one hour.

29 July 1962

A pre-work meeting was held to finalize the last details before firing. The American group strongly recommended that the vertical test be re-run prior to an actual firing and this was taken under consideration. It was decided that all status lights would be green from the start of the count, except for the X -65-

minute check for system malfunctions and that the minimum hold would be at X -3 minutes and not longer than 15 minutes. This was due to the helicopter's operational time requirements.

During the rest of the working day, several problems occurred. Discriminator No. 1 blew a fuse and it was found that the 12Q8 (2N1329) transistor was bad. No transistor was available; therefore, it was necessary to switch to the spare discriminator (No. 6). The right timing galvanometer failed, and had to be replaced. AGC bucking voltage supply had 50 cps ripple superimposed on it. The circuit had to be modified to eliminate this ripple.

The FIRST MOTION switch, on the rocket launcher, was reconnected to start the ground station counter, instead of stopping it at launch. This was to give + time. Checkout of the primary timing counter was undertaken to establish the error in its count. It was found that there was 1.5 seconds error every 24 hours. The fire control panel (GO or NO GO lights) were still not operating properly. During the vertical, it was noticed that the recovery communication transmitters were interfering with the telemetry signals. Because of this it was decided to have radio silence between X -11 to X -6 minutes and X -4 to X +5 minutes.

Payload tests conducted showed a minor amount of interference on the 10.5-kcs channel. It was concluded that the interference was coming from spikes on the 22-kcs channel. A change in electrostatic data appeared when the payload was switched from external to internal power. This was probably due to the line drop in the umbilical cable. (NOTE: The experiment drew 5 amps.)

By the end of the day, the communications problem which had been previously noted, between the Swedish and American groups had not been successfully resolved.

30 July 1962

The press show was held for the Swedish news services. No serious work was planned. The press and the Swedish Space Committee were shown through "Cape" Kronogard.

31 July 1962

It was decided that a second vertical check was more important than an attempt to fire, and the vertical was re-run. All systems were found to be operational with a minimum of problems.

1 August 1962

Countdown was started for an auroral event, using telemetry system No. 1 and experimental package No. 3. At X -90 minutes,

a test was run and the telemetry transmitter was noted to have no modulation. This problem was finally resolved by the payload group and the countdown was continued until 1150Z, when the launch was cancelled due to high winds at 7000 km.

2 August 1962

The countdown was resumed at 1800Z. A telemetry check was held successfully at X -90 minutes. Ground station calibration was completed at X -35 minutes. The flight was cancelled at 0150Z on 3 August due to the absence of noctilucent clouds.

3 August 1962

Resumption of the countdown occurred at 1630Z. The telemetry station was manned at 1730Z and the X -90 minute check occurred without incident. The countdown was held at X -30 minutes and, when noctilucent clouds did not appear, the flight was cancelled.

Oscillograph processing chemicals, which were mixed on 24 July, were discarded.

4 August 1962

The Range timing standard (the counter installed in the telemetry van) was checked and reset to the Swedish standard tone at 1300 CEST. The telemetry station was manned at 1720Z, and the X -90 minute check occurred on schedule. Launch was again cancelled as a result of the absence of noctilucent clouds at 0205Z. No work scheduled until 6 August.

6 - 7 August 1962

Countdown progressed smoothly and X -90 minute checks were good. The ground station was calibrated at X -15 minutes. A fuse in the CEC 5-119 oscillograph recorder blew at X -6 minutes, but this was corrected immediately.

Nike Cajun K62-1 was launched at 00-47-08 GMT into an aurora event (no noctilucent clouds). The Nike booster burned for 3.3 seconds with Cajun ignition at X +16.8 seconds and Cajun burnout at X +19.8 seconds. Tip ejection was at X +73 seconds and payload separation occurred at X +245.7 seconds. There was no indication of SARAH operation, although the telemetry signal was received for 376 seconds. The damaged payload was located with the aid of sound ranging and some useful data was collected.

Several short paper records were made at 0.16"/sec. to determine azimuth from AGC and magnetometer data. This proved not to

be too successful. All magnetic tape channels were checked for data and all were found excellent. Rocket impact was 2 km from that predicted. Launch angle was 87.4° effective, at an azimuth of 296° with the winds at 1.3 meters/sec at 249° azimuth.

An ARCAS vehicle, designated K62-2 was also launched.

8 August 1962

Reported on station at 1500 (local time) for payload checkout. At 1600, a decision was made to cancel Nike Cajun Flight K62-3 due to unfavorable weather conditions. As a result, payload checks were not completed and the station secured at 1730.

9 August 1962

The station was manned at 1915Z and payload checks were completed successfully. Launch of Flight K62-3 was cancelled at 0100Z.

C. D. Tackett departed Sweden bound for NASA/GSFC.

10 - 11 August 1962

Reported on station at 1820Z. Timing reference was started at 2125Z. Payload check indicated problems with the commutator. In addition, receiver No. 1's video was distorted while that of receiver No. 2 was normal. It was decided to use receiver No. 2 as prime (providing the real-time record). This eliminated the availability at the antenna of the tracking meter for aiding in manual pointing of the telemetry antenna and it was necessary to track by phone communications between the tracker and ground station operator. With the exception of the commutator problem, all payload checks were held satisfactorily and it was decided to launch Flight K62-3.

A hold occurred at X -75 minutes due to weather and again at X -35 minutes due to a lack of noctilucent clouds. Lift-off occurred at 01:4811Z, 11 August. The flight went well with the exception that the commutator and magnetometer data were intermittent during the flight and the telemetry signal was lost at X -9 seconds indicating successful parachute deployment. However the flight was considered successful.

No work scheduled until 14 August.

14 August 1962

The station was manned at 1630Z. Preliminary payload checks were held at 1735Z and all systems checked satisfactorily. Flight K62-4 was cancelled at 0145Z, 15 August.

15 August 1962

Reported on station at 1800Z. Pretests were performed successfully. Launching of Flight K62-4 was cancelled at 0230Z, 16 August.

16 August 1962

Reported on station at 1900Z and all preliminary checks were satisfactory. The X -35 minute prelaunch check was held at 1040Z. Launching of Flight K62-4 was cancelled shortly after the test.

17 - 18 August 1962

On 17 August, the station was manned at 1900Z, but the launch was cancelled at X -35 minutes.

The station was re-manned at 1845Z, 18 August. All countdown checks were completed successfully with Flight K62-4 lift-off occurring at 00:5739Z. Telemetry signal strength was low during flight; however, data was recovered successfully. Signal was received for 325 seconds.

19 - 31 August 1962

Between 19 and 24 August 1962, all attempts to launch Nike Cajun Flight K62-5 were cancelled due to weather problems. From 25 to 27 August, no flights were scheduled. On 28 and 29 August, the station was manned at 1800Z and successful checks were made. On both days, the launching was cancelled.

At 1800Z, 30 August, the station was manned. All system checks were performed successfully and Flight K62-5 was launched at 00:5607Z, 31 August. Telemetry signal was recorded to X +323 seconds. The flight was not considered successful because (1) the electrostatic analyzer did not function, (2) the payload did not separate, (3) the recovery package did not function, and (4) the photomultiplier high voltage supply failed at Cajun ignition.

R. Anstine left Sweden for NASA/GSFC.

Mobile station E was packed for shipment to the U.S., which was handled by the Swedes. The trailer arrived at GSFC in mid-October 1962.

EUROPEAN SPACE RESEARCH ORGANIZATION (ESRO) RANGE PLANS

The following represents excerpts from a memorandum on KGO and ESRO Range Plans by Richard Barnes, NASA Headquarters dated August 17, 1962.

The participants in a discussion of the plans were:

Dr. Bengt Hultqvist, Director
Kiruna Geophysical Observatory of
Swedish Royal Academy of Sciences

Fellows and Barnes, NASA

The only Swedish Observatory located above the Arctic Circle is that on the KGO Range. The buildings were finished in 1957; however, various geophysical observations had been taken regularly at Kiruna since 1948. The staff, currently, numbers 25, including 7 scientists and 7 engineers. Upper atmosphere physics, with a heavy emphasis on the ionosphere, is a principal object of study at the KGO Observatory.

The Observatory also provides observational support for a number of other scientific research institutes (seismology, meteorology, and cosmic rays) in Sweden because of the unique location.

One third of KGO's annual budget is appropriated by the Government through the Academy of Sciences. The remainder comes through contracts from other institutions. A substantial number of these institutions are U.S. military laboratories although all KGO work is unclassified and the results are published. There is a riometer at the Observatory and an ionosonde which is one of the six-station informal NATO network of ionosondes coordinated by Dr. Arends of Air Force Cambridge Research Laboratories.

Dr. Hultqvist is also planning to participate in S-66 ionosphere beacon satellite ground studies and is in touch with NASA (Bourdeau).

KGO has recommended sounding rocket experiments to the Swedish Space Committee. One involves the measurement of the electron to negative ion ratio (λ) in the 40-80 km altitude region. This would be part of the longer range program of the Observatory to study Polar Cap Absorption.

Kiruna has a population of 27,000. The temperature goes down quite low (-20 to -30°F) in winter. It is, however, a dry cold. The sun does not rise from about the first of December through the middle of January.

Kiruna was founded in the late 1890's as a company town for LKAB (Luossavaara Kirunavaara Aktiebolaget), an iron ore mining enterprise. Magnetite from rich deposits in the Kiruna area are partially refined and then shipped by rail, both south to Stockholm and northwest to Narvik, Norway. LKAB was originally owned 50% by the Swedish Crown and 50% by private interests, but is now almost 100% State-owned. It is apparently quite profitable, not only to the Swedish Government but also to the town of Kiruna, which, as a result of LKAB taxes, enjoys an excellent school system, well paved streets, lots of new apartment buildings, and other public services. It has also become a tourist center in Swedish Lappland, as the jumping off point for various attractions in "the land of the midnight sun".

Shortly after the visit of Fellows and Barnes of NASA, the annual Congress of Lapps took place at the ESRO range. In a newspaper dated shortly thereafter, it was stated that one of the resolutions adopted at the Congress was an objection to the establishment of the ESRO range.

ESRO RANGE

The base of the range is approximately 40 km east of Kiruna, and 20 km east of Jukkasjaarvi, the nearest town and the oldest Swedish settlement in Lappland (established in 1608). The administrative center will be located a few hundred yards away from the launch pad. Preliminary site surveying has been completed and work is going ahead on the access roads. Actual range construction will not start until the formal establishment of ESRO. The spring of 1963 is the predicted time. It is not expected that the first launchings will take place until the summer of 1964.

The range is roughly diamond shaped, 120 km in its on (northerly) dimension and 80 km across. Detailed maps covering the area of the range are available in the NASA Office of International Programs' files.

Two elderly Lapps are the only permanent residents of the area covered by the range. The principal hazards problem is posed by the annual summer migration of several hundred Lapps with their reindeer herds in a northwesterly direction across the range into Norway; they return the opposite direction in September and October. Many alternatives for safeguarding these Lapps and their reindeer have been studied. One under consideration would schedule specific time periods for experiments (e.g. a two-week launching period, followed by two weeks of no launchings). These would be widely publicized among the Lapps. In addition, Lapps in the area would be equipped with very small single channel transistor radios on which an alarm signal would be broadcast just before launches. The

Lapps could then take shelter in the terrain. Swedish studies indicate that, statistically, it would be a thousand times more dangerous to attempt to evacuate the Lapps by helicopter than to have them take shelter on the range during launchings.

Dr. Hultqvist observed that although the Lapps were making some political fuss over the planned range, it would actually be quite a good thing for them. More access roads to their reindeer grazing area would be provided which would enable many of them to settle down permanently in town and commute by automobile to their herds.

APPENDIX A

INVENTORY LIST

EQUIPMENT IN NASA TRAILER LICENSE #NA1179
FOR SHIPMENT TO SWEDEN

Five (5) of each value of the following: 1/2 watt

51 ohm resistor	820 ohm resistor
56 ohm resistor	910 ohm resistor
68 " "	1 K ohm resistor
75 " "	1.1 "
82 " "	1.2 "
100 " "	1.3 "
110 " "	1.5 "
120 " "	1.6 "
130 " "	1.8 "
150 " "	2 "
160 " "	2.2 "
180 " "	2.4 "
200 " "	2.7 "
220 " "	3 "
240 " "	3.3 "
270 " "	3.6 "
300 " "	3.9 "
330 " "	4.3 "
360 " "	4.7 "
390 " "	5.1 "
430 " "	5.6 "
470 " "	6.2 "
510 " "	6.8 "
560 " "	7.5 "
620 " "	8.2 "
680 " "	9.1 "
750 " "	10 "
11 K ohm resistor	150 "
12 " "	160 "
13 " "	180 "
15 " "	200 "
16 " "	220 "
18 " "	240 "
20 " "	270 "
22 " "	300 "
24 " "	330 "
27 " "	360 "
30 " "	390 "
33 " "	430 "
36 " "	470 "
39 " "	510 "
43 " "	560 "
47 " "	620 "
51 " "	680 "
56 " "	750 "

**EQUIPMENT IN NASA TRAILER LICENSE #NA1179
FOR SHIPMENT TO SWEDEN (con't)**

63	K ohm resistor	820	K ohm resistor
68	"	910	"
75	"	1	Meg ohm resistor
82	"		
91	"		
100	"		
110	"		
120	"		
130	"		

**EQUIPMENT IN NASA TRAILER LICENSE #NA1179
FOR SHIPMENT TO SWEDEN TOOL BOX #17**

Quantity

1	6" Steel Rule
2	Ungar Soldering Iron Handle
4	Ungar Element
1	"C" Clamp
1	Hand Punch
1	4 1/2" Diagonal Wire Cutting Pliers
2	Offset Screwdrivers
4	Small Pin Vises
2 sets	Allen wrenches and case (1 set 8 pcs.)
6	Jewelers Screwdrivers
2	8" Adjustable Wrench
2	6" " "
2	4" " "
2	Screw Holding Screwdrivers
2	Angle Nose, Multi-Tongue Slip-Joint Plier
2	2" Bench Vise
1	Half Round 8" File
1	Round File 8"
1	Flat File 6"
1	Calibrator
2	Large Hammers
1	Small Ball-Peen Hammer
2	Duck Bill Wiring Pliers
2	1/4" & 3/16" Open End Wrench
2	5/16" & 3/8" " " "
2	3/8" & 7/16" " " "
2	7/16" & 1/2" " " "
2	1/2" & 9/16" " " "
2	5/8" & 9/16" " " "
2	9/16" & 3/4" " " "
1	X-Acto Knife
1	Vise Grip Wrench Plier
2	3" Phillips Head Screwdriver

<u>Quantity</u>	<u>TOOL BOX #17 (con't)</u>
2	6" Phillips Head Screwdriver
1	8" " " "
1	3/4" Screwdriver (Pocket)
1	1" " (Big End)
1	3" " (Small End)
1	6" " (Small End)
1	6" " (Big End)
1	8" " (Small End)
1	6" Irwin Screwdriver (Big End)
2	Thin Nose Slip Joint Pliers
2	6" Diagonal Plier
2	4" " "
2	6" Needle Nose Plier with Cutters
1	3/16" Wrench Screwdriver (Spintite)
1	1/4" " "
1	11/32" " "
1	5/16" " "
1	3/8" " "
1	1/2" " "
1	9/16" " "
1	12" Combination Square
1	Weller Soldering Gun
2	4 1/2" Utica Short Chain Nose Pliers
1	Soldering Aid
2	Miller Wire Stripper
1	8" Flat File
1	8" Square File
1	8" 3 Square File
1	8" Half Round File
1	8" Round File
2	12" Adjustable Wrench
1	60 Watt Soldering Irons
1	100 Watt Soldering Irons
1	Weller Soldering Irons
1	Tektronix Oscilloscope, Model RM16, GSFC 22571
1	Hewlett-Packard Electronic Counter, Model 523CR, GSFC 22572
1	Hewlett-Packard Wide Range Oscillator, Model 200 CDR, GSFC 22573
1	Boonton AM/FM RF Signal Generator Model 202G GSFC 22575
1	Voltmeter Ballantine, Model 300 H Vacuum Type, NASA Serial #22920
1	Power Supply, Harrison Lab., Model 800 B-Z Serial #569, NASA #23310
8	Connector for Galvanometer Input to CEC Model 5-124, Recording Oscillogram 18 channel
1	Oscillogram Processor CEC Type 23-109A-PA, S/N 6010, NASA 16707

TOOL BOX #17 (con't)

<u>Quantity</u>	
2	Hewlett-Packard Power Supply Model 721
	NASA #23185, Serial #024-13095
	NASA #23814, Serial #024-12946
15 bottles	CEC Datarite Developer, Part #49943-4
12 rolls	Datarite Type 33, 12 x 400' Part #158076
10 rolls	Magnetic Instrument Tape Scotch 1.0mil
20 rolls	Magnetic Instrument Tape Scotch 1.5mil
20 rolls	7 x 200', Linograph Direct Print Paper
12 rolls	Lino write #2-W Recording Paper
1	Collins 51J Communication Receiver
6	Spare Subcarrier components consisting of Station Multiplex:
	1 TV-53 Voltage Regulator Serial #655
	1 TA-58A Mixer Amplifier Serial #10
	1 TS-56 Subcarrier Oscillator 70Kc S/N 3101
	1 TS-56 Subcarrier Oscillator 30Kc S/N 1180
	1 TS-56 Subcarrier Oscillator 14.5Kc S/N 3056
	1 TS-56 Subcarrier Oscillator 7.135Kc S/N 250
4	Microswitches
2	P & B Latch Relay SL-11DF
2	P & B Relay non-latch SC-11DF
4	P & B Relay Sockets
30	UF-88 Coaxial Connector
1/2 pint	Alcohol
1 box	Miscellaneous Nuts and Bolts
100 feet	RG-62 Coaxial Cable 90 ohm
50 feet	RG-214 Coaxial Cable with Connectors
4	UG-18C Coaxial Connectors Type N
2	UG-27 B/U Right Angle Adapter Type N
5	Processing Kits for DuPont Line Write Papers
1	100 watt Soldering Iron (American Beauty) with Temperature Regulating Stand
1 roll	Electric Tape FSM 5970644 3169
2 rolls	1/2" Electrical Tape
*3	3 Prong Male Connectors
*3	2 Prong Male Connectors
6 rolls	Tuck Tape 2"
1 roll	Electric Tape Type 27
4 rolls	Tuck Tape 1"
1	Bench Vise Stand
3 rolls	3/4" Electrical Tape
1	Bench Vise (Small)
1	Bench Vise (Large)
1/2 roll	2" Tape
1	Flashlight
50 feet	RG214, RF Cable
1 bottle	Radio Service Cement
1	8 Turn Helix Antenna
1	6 Element Yagi Antenna with base plate

TOOL BOX #17 (con't)

Quantity

31 cans	Insecticide FSN 6840-254-8770
6 cans	Insect Repellent FSN 6840-030-0036
2	Head Set
1	Burgess 9 Volt Battery Type 4F6H
3	Type 27 Electrical Tape
2	Type 33 Electrical Tape
2	General Electric 12 inch, 2-speed table fans
2	General Electric Fan Heater Model F41H6
2	15lb. CO ₂ Fire Extinguishers, Model FF-15
	S/N G-511043, and H-151
2	2 1/2 lb. CO ₂ Fire Extinguishers Model
	2 1/2 R S/N J90965 and 51353
1	Intercom II
1	3.4 ohm 4" Speaker, Rack Mounted
1	Weksler Recording High & Low Temperature
	Thermometer
1	Remote Signal Strength Meter for Antenna
	Pointer
10	15" Patch Cables BNC to BNC
15	23" Patch Cables BNC to BNC
2	12" Patch Cables BNC to BNC
3	25" Patch Cables BNC to BNC
2	30" Patch Cables BNC to BNC
18	25" Patch Cables PL068 to PL068
1	35" Patch Cables PL068 to PL068
1	30" Patch Cables GR to GR
2	2010A End Fitting
42	Banana Plug, 5935-C07-0710
12	Bulldog Solderless Connectors
12	Large Wire Nuts (Splice)
2	12' Length of 14-3 Power Cord with Con-
	nectors (for processor)
12	Jack, phone tip (green)
3	Cap & Chain for BNC Connector

EQUIPMENT IN NASA TRAILER LICENSE #NA1179

FOR SHIPMENT TO SWEDEN

1	UG-30/U Connector
3	UG-201A/U "
14	UG-914/U "
22	UG-274 B/U Tee Type Connector
3	UG-492 C/U Connector
4	UG-491 B/U
4	UG306 A/U Elbow Connector
12	UG-1094/U Adapter Connector
3	UG 30D/U Connector
9	5U4GB Tubes
6	5642 "

EQUIPMENT IN NASA TRAILER LICENSE #NA1179
FOR SHIPMENT TO SWEDEN (con't)

<u>Quantity</u>	
1	5R4WGB Tubes
4	6080 "
1	6AU5GT "
2	5Y3WGTA "
3	6DC6 "
2	6AC7 "
1	5Y3GR "
1	CRC6H6 "
1	6SN7GTB "
1	6SJ7WGT "
1	OA3 "
1	6A57G "
3	6080WA "
7	6CB6A "
16	12AU7 "
5	6DC6 "
5	6AU6 "
3	6DJ8 "
2	6CL6 "
2	6U8A "
3	6BE6 "
6	6AU6WA "
1	6AW8A "
3	6AS6 "
2	6AN8 "
2	6AQ5A "
4	Recorder Lamps GE 1926
1	6AF4A Tubes
3	6AK5 "
2	6AL5 "
3	3V4 "
2	2D21 "
2	7077 "
1	OB2 "
1	OA2 "
6	5963 "
2	GL5725 "
3	5915 "
2	12AT7WA "
1	5651 "
3	12B4A "
1	6CA5 "
1	6AU5 "
1	6H6 "
3	6SN7 "
1	6SJ7 "
1	6U8 "

EQUIPMENT IN NASA TRAILER LICENSE #NA1179

FOR SHIPMENT TO SWEDEN (con't)

<u>Quantity</u>	
2	6AK5 Tubes
1	2D21 "
6	5751 "
3	6CW5/EL86 Tubes
3	5AR4 Tubes
2	7308 "
10	MDL-1 Fuse
15	MDL-1/2 Fuse
15	MDX-1 1/2 Fuse
15	1A3AG5B Fuse
15	MDX-3 Fuse
15	MDX-2 Fuse
15	MDX-5 Fuse
10	FNM 12/32"x1 1/2" 5 amp. 250 volt Fuse
10	FNM 12/32"x1 1/2" 10 amp. 250 volt Fuse
5	1N34A Diodes
5	1N457 Diodes
3	1N211 Diodes
3	1N216 Diodes
3	1N1695 Diodes
6	Zener Diode Type 1N467
2	" " " 10M39Z5
4	" " " 10M150Z5
2	Transistor Type 2N669
8	Tung-Sol Lamps 2.25V
1	21FLO Filament Transformer
11	PJ-068 Plug
10	Alligator Clips & Covers
2	2N332 Transistors
1	Ampex PN 15607-1 Transformer for Connecting Chassis Power Supply (FR 100)
3	Ampex PN 081-002 Drive Belt for FR 100 Tape Transport
2	Lamp, Clamp CEC P/N 158501
1	Electrode Spark (E-110) CEC P/N 158508
5	Rectifier, Power (AG-1012) CEC P/N158533
1	Lamp Anchor & Clip Ass'y. CEC P/N 158543
1	Blower Motor Assembly CEC P/N 158715
2	Lamp-Mercury Arc (DX-101) CEC P/N 154224
4	Transistor, Power 2N173 CEC P/N 157295
33	Wire Nuts (various sizes)
5	XX-30 Batteries
48	D Batteries
48	AA Batteries
2	Telephone Sets (TA-43/PT)
60 feet	RG58
200 feet	#20 Wire

**EQUIPMENT IN NASA TRAILER LICENSE #NA1179
FOR SHIPMENT TO SWEDEN (con't)**

<u>Quantity</u>	
100 feet	#10 Wire
8	100 Watt Light Bulbs
4	Fluorescent Light Bulbs
2	Thermometers 8" Stem, Model 2261
	Cat. #0010.26
2	Flashlights W-F-42 lb
46	Capacitors (miscellaneous) consisting of:
	3 each 24 uufd
	3 each 30 uufd
	5 each 68 uufd
	6 each 120 uufd
	2 each 220 uufd
	1 each 330 uufd
	3 each 360 uufd
	5 each 500 uufd
	5 each .001 ufd
	3 each .0015 ufd
	5 each .002 ufd
	2 each .01 ufd
	3 each .1 ufd
500 feet	Twisted pair #19 Solid Cable
250 feet	Lamp Cord #16
2	25 feet extension cords
1	First Aid Kit
1	Electric Hand Drill
1	Set Index Drills
2	3 Volt Batteries for Simpson Meter
2	Swivel Chairs NASA #5939, 6258
1	Box Misc. Stationary
1	Hacksaw
12	Hacksaw Blades
1	Simpson Model 270 Volt Ohm Meter
2	Transformers, Model #9T21A1052, Serial #TW
1	Recording Oscillograph Model 5-119-P4-5
	S/N 12043
1	Datarite Magazine Model 5-036A S/N 3034
1	Record Magazine Model 5-006A S/N 9048 GSFC
	19767
32	Galvanometers, consisting of:
	2 ea 7-002 No S/N
	6 ea 7-342 S/N 2634, 2584, 2690,
	2708, 2591, 2630
	18 ea 7-362 S/N 5390, 5559, 5347, 5312,
	5660, 5657, 2552, 2402,
	4108, 4183, 5646, 5661,
	5662, 5663, 5649, 5647,
	5656, 5653.
	6 ea 7-363 S/N 1260, 1346, 1343, 1103,
	1138, 1217.

**EQUIPMENT IN NASA TRAILER LICENSE #NA1179
FOR SHIPMENT TO SWEDEN (con't)**

<u>Quantity</u>	
1	Special Purpose Receiver, Nems Clark Model 1906 Serial No. 187, GSFC 22574
1	Patch Panel Model 56-8213A
1	Line Amplifier Model 173 S/N 63
1	CEC Recording Oscillograph Model 5-124 GSFC 22575
1	EMR Rack Adapter Model RA-167a
6	Subcarrier Discriminators, EMR Model 167A-01 S/N 176, GSFC 22576 " 172, " 22577 " 174, " 22578 " 171, " 22579 " 173, " 22580 " 175, " 22581
1	Power Control Panel, Model 801A
1	Power Control Panel, EMR Model 801C
1	McLean Rack Mounted Blower Assembly
1	Special Purpose Receiver, Nems Clark Model 1501, S/N 226, GSFC 9081
1	ASCOP Pre-amp Power Supply Model APA-2PS S/N 10314
1	ASCOP Pre-amp Model APA-2, S/N 11924
1	Subcarrier Oscillator & Moxer Panel, con- sisting of: 4TS-56 Oscillators, 70kc, S/N 3094-5; 30kc, S/N 1185; 14.5 kc, S/N 2924-5; 7.35kc, S/N 1048 1 each Mixer Amplifier, TA-58A, S/N 706 1 each Six Volt Regulator TV-53, S/N 661
2	Ampex Power Supply Pn 15600-1, S/N 6866, S/N 6854
1	Model 391, Control Track Demodulator, No.
1	Model 375, Precision 60 cps. Amplifier S/N 219
1	Blower and Power Control Panel, S/N 108
1	Tape Transport, Ampex Model FR-1100
1	3 Unit Plug-Inchassis
1	Cable Termination Panel
2	Direct Record Amplifiers, P.N. 15550, S/N 4415, S/N 4510
1	Control Track Generator, S/N 354
2	Direct Reproduce Amplifier, S/N 4608, S/N 4633
2	60 IPS Compensators
2	30 IPS Compensators
1	Magnet Tape DeGausser Model SE-10, S/N270

Low Pass Output Filter Model 167C-02

<u>Freq.</u>	<u>S/N</u>	<u>Freq.</u>	<u>S/N</u>
6 cps	345	220 cps	357
8.4 cps	346	330 cps	358
11 cps	347	450 cps	359
14 cps	348	600 cps	360
20 cps	349	660 cps	363
25 cps	350	790 cps	361
35 cps	351	900 cps	364
45 cps	352	1050 cps	362
59 cps	353	1200 cps	365
81 cps	354	1000 cps	366
110 cps	355	2100 cps	367
160 cps	356		

Channel Selectors

<u>Freq.</u>	<u>S/N</u>	<u>Freq.</u>	<u>S/N</u>
.400 KC	224	30 KCB	243
.560 KC	225	40 KC	239
.730 KC	226	40 KCC	244
.960 KC	227	52.5 KC	240
1.3 KC	228	52.5 KCO	245
1.7 KC	229	70 KC	241
2.3 KC	230	70 KCO	248
3.0 KC	231		
3.9 KC	232		
5.4 KC	233		
7.35 KC	234		
10.5 KC	235		
14.5 KC	236		
22 KC	242		
30 KC	238		

- 24 Galvo Lamps GE1926
- 8 Sets Test Clips
- 1 Vise Grip Pliers
- 1 Screw Holding Screwdriver

AMPEX EQUIPMENT

Quantity

1	Amplifier Mtg. Assy. Cat. No. 26061-1 S/N 231
1	" " " " No. 15730-3 S/N 594
1	" " " " No. S/N none
1	" " " " No. 15730-1 S/N 812
1	" " " " No. 15730-5 S/N 3412
4	Power Supply Cat. No. 15600-1
	S/N 1033, 1293, 1055, 1253
3	Direct Record Amplifier Cat. No. 15550-1
	S/N 592, 1032, 558
1	Direct Reproduce Amplifier Cat. No. 15560-1
	S/N 664

AMPEX EQUIPMENT (con't)

Quantity

1	Prec. Freq. 60 cps Cat. No. 25910-1, S/N 392
1	Reproduce Heads Cat. No. 15005-2, S/N 50112
2	Direct Reproduce Amplifier Cat. No. 15560-1 S/N 1148, S/N 6751
2	Direct Record Amplifier Cat. No. 15550-1 S/N 1054, S/N 528
1	Magnetic Record Head
1	Magnetic Record Head
1	Magnetic Head Reproduce
1	Magnetic Head Reproduce

APPENDIX B

LAUNCH COUNTDOWN PROCEDURE

Time	Rey	Ortner	Witt	Recovery	Payload	Telemetry	Lundblad	Function
1530	x	x	x	x	x	x	x	Prefiring conference
1550	x	x	x					Auroral prognosis
1600							x	Brief Air Force Range
				x				Brief radar and range flight control
		x	x					Brief Kristineberg and Kiruna
X-5 h	x						x	Rocket group starts. GREEN (firing control room manned until X)
	x						x	Ribbon frame prep starts. GREEN
							x	15-min. counting starts
X-4 h	x					x		TM group starts. GREEN (TM van manned until impact)
	x				x			Payload group starts. GREEN (payload console manned until X)
							x	High altitude balloon ascent starts
1900							x	Confirm range evacuation
X-3 h	x			x				Recovery control starts. GREEN (RC manned until recovery is over)
					x		x	Payload mated to Cajun
								Firing control room manned
X-125 m							x	Balloon ascent starts
X-120 m	x			x				Recovery stations start
							x	5-min. counting starts
X-105 m					x		x	Plastic bag removal
X-100 m							x	Vehicle ready
								Payload control manned
X-90 m		x	x				x	Open telephone lines to Kristineberg and Kiruna established
						x		TM test starts

Time	Rey	Ortner	Witt	Recovery	Payload	Telemetry	Lundblad	Function
X-89 m					x			Payload test starts
X-80 m							x	Launcher settings computed
X-75 m							x	Prel launcher setting starts
X-65 m	x	x	x	x	x	x	x	All control lights to RED for 30 sec.
							x	Low altitude balloon ascents start
X-60 m							x	Prel launcher setting over
				x	x			Helicopter at Kronogard
X-50 m							x	Change winddetermination baseline
X-35 m							x	Final launcher settings computed
X-30 m	x			x			x	Check range evacuation
							x	Final launcher setting starts
X-20 m							x	Final launcher setting over
							x	Short interval balloon ascents start
					x	x	x	Payload safety key to Lundblad
								Disconnect TM console power
							x	Kronogard evacuation bus in front of main building
X-15 m							x	Connect rocket firing circuits
							x	Evacuate pad (evacuated until impact)
X-12 m					x	x	x	Payload safety keys returned to console - Connect TM console power
X-11 m				x				Helicopter to waiting position
							x	1-min. counting starts. Siren will from now on indicate that the count-downpickup at X-11 min is due within 2 minutes. The siren is now a signal for the helicopter recovery crew to start.
				x		x		C 45 radio silence starts
X-10 m						x		TM on external power

Time	Rey	Ortner	Witt	Recovery	Payload	Telemetry	Lundblad	Function
							X	Evacuate Kronogard
							X	One man at Main generators ready to switch over in an emergency (until recovery is completed)
X-8 m					X			Final payload test
							X	No cars started in vicinity of Kronogard (until X+20 min)
X-6 m				X		X		C 45 radio silence ends
X-5 m							X	Test rocket ignition circuits
							X	Last balloon ascent starts
			X				X	Countdown relayed to Kristineberg
X-4 m			X			X		C 45 radio silence starts
X-3 m	X	X	X	X	X	X	X	Deadline for riometer holds. Latest hold time for riometer holds. Latest countdown pickup time for later holds. Holds on this level longer than appr. 30 min requires countdown pickup at appr. X-40 min. A siren signal will be given
X-2 m					X			TM to internal power
							X	5-sec counting starts
X-60 s					X			Payload ready to go
					X			Arm flare ignition circuits
							X	Prearm rocket ignition circuits
X-30 s							X	Arm rocket ignition circuits by safety key
							X	Siren
X-10 s							X	1-sec counting starts
X-7 s							X	Ribbon Frame cameras start
X							X	PTB

Time	Rey	Ortner	Witt	Recovery	Payload	Telemetry	Lundblad	Function
				X				Recovery countup starts
X+2 m						X	X	10-sec counting starts
X+5 m				X	X			30-sec counting starts (until impact)
X+20 m							X	C 45 radio silence ends
X+30 m	X	X	X	X	X	X	X	Car starts permitted again
								Earliest time for countdown critique
<ul style="list-style-type: none"> * Switch control lights to RED at the beginning of a hold * Switch back to GREEN when the countdown pickup is announced. * During a hold the C45 radiosilence can be broken after permission from Ortner - Rey * The countdown will be held immediately on RED from TM, payload or recovery. 								

APPENDIX C

FLIGHT PLAN AND POST LAUNCH REPORTS

FLIGHT PLAN
NIKE CAJUN NOCTILUCENT CLOUD SAMPLING
EXPERIMENT

Section I - GENERAL OPERATIONS

A. Firing Plan

Four rockets will be fired during hours of darkness during August 1962. Two of these will be launched into noctilucent clouds and two will be launched in the presence of aural events but when noctilucent clouds are absent.

B. Flight Objectives

To collect samples of noctilucent clouds; to obtain electron energy spectra; and to obtain information on heavy particles.

C. Flight Information

This rocket is capable of attaining an altitude of 65.5 statute miles when launched at an elevation angle of 87° . The slight overdiameter of the payload is considered, as well as the four quadraloop antennae.

SECTION II - ROCKET INFORMATION

A. Rocket

The rocket will be the standard GSFC Nike Cajun vehicle. The Cajun motor will utilize a 17 second delay igniter.

B. Performance

Based on an 80 pound payload at an 87° launch angle with the sampling experiment drag configuration, the performance will be:

Booster ignition time	0.0 sec.
Booster burnout time	3.5 sec.
Booster burnout velocity	33,730 ft/sec
Booster burnout range	346 ft
Booster burnout altitude	7145 ft
Cajun ignition time	17 sec.
Cajun ignition velocity	1573 ft/sec.
Cajun ignition range	2361 ft.
Cajun ignition altitude	37,050 ft.

Cajun burnout time	21 sec.
Cajun burnout velocity	5002 ft/sec.
Cajun burnout range	3463 ft.
Cajun burnout altitude	51,095 ft.
Peak time	157.5 sec.
Peak altitude	49,169 ft.
Impact time	345,875 ft.
Impact range	316.7 sec.
	98,291 ft.

C. Recovery

Physical recovery of the payload is required. The payload will be severed from the second stage bottle by primer cord. The recovery system is the Cook package.

D. Weights and Dimensions

1. Weights and C.G.'s

Nike booster	1246 lbs	
Nike fins	77 lbs	
Nike Cajun adapter	<u>27 lbs</u>	
Total Nike booster		1350 lbs
Payload weight	85 lbs	
Cajun weight	<u>202 lbs</u>	
Total rocket weight		1637 lbs

2. Rocket Dimensions

Payload length	70 in.	
Cajun length	107 in.	
Total second stage		177 in.
Nike (plus adapter) length		149 in.
Total rocket length		326 in.

E. Modifications

Forward section of the nose replaced by clam shell to house the sampling cans.

F. Installations

The following equipment will instrument the payload:

1. Two sampling cans
2. A timer to control the sequence of events
3. A nuclear emulsion pack
4. An electron spectra analyzer

5. FM-FM telemetry
6. Quadraloop antennae

G. Pyrotechnic Installations

1. Explosive bolts to split the clam shell
2. Primer cord to separate the payload from the rocket

SECTION III - EXPERIMENT AND INSTRUMENTATION

A. The purposes of this flight are:

1. To gather samples of noctilucent clouds; to determine the composition of the clouds from these samples.
2. To determine the energy level of the electrons over the altitude range.
3. To determine the mass and velocity of the heavy particles from a nuclear emulsion pack.

SECTION IV - FIRING RANGE

A. Radio Frequencies

1. FM-FM 225 mcs
2. SARA recovery system 243 mcs

B. Range Safety

Normal for Nike Cajun launchings. No destruct system will be used.

C. Ground Station Support

The GSFC-supplied telemetry trailer will be located near the launcher.

D. Radar Beacon

None

E. Meteorological Support

The upper air winds will be measured daily. Pibald balloons will be used with double theodolites to determine the lower level winds through the level of Nike burnout. Sweden will provide this data.

F. Ballistic Data

Optical tracking and telemetered acceleration data will be used as prime means of determining the rocket position.

G. Communications

Sweden will provide the necessary cabling from the launcher to the blockhouse and telemetry trailer.

SECTION V - PHYSICAL RECOVERY

Physical recovery is required to fulfill two of the three missions of these experiments. The following aids to recovery will be used. Chaff will be packed in the parachute to enable the available radar systems to pick up the parachute upon deployment. Three sound ranging systems will be operated to determine the points of origin for the reentry waves. Three ground based SARAH receivers will be employed at the same sites as the sound ranging stations to track the SARAH beacon located in the payload. One airborne SARAH receiver will be located in a helicopter which will participate in the recovery. In addition, flares will be used on the Cajun fins to get an Askania fix on the azimuth at second stage burnout.

SECTION VI - FACILITIES AND SERVICES

- A. Range Instrumentation as described in Section IV.
- B. Meteorological support described in Section IV.
- C. Rocket preparation

Rocket preparation to include fin alignment, igniter insertion and determination of weight, length and C.G. will be done by Swedish personnel.

- D. Laboratory Space

Buildings to be used for payload assembly and rocket preparation will be provided by Sweden.

10 August 1962

SWEDEN PROJECT

Reference: NASA REPORT OF SOUNDING ROCKET LAUNCHING

Vehicle No.: K62-1
Rocket Type: Nike-Cajun
Launching Site: Kronogard, Sweden
Project Manager: Lars Rey
Project Scientists: Johannes Ortner
George Witt

1. OBJECTIVES AND INSTRUMENTATION

(a) Direct sampling of noctilucent clouds for laboratory examination. This is to be accomplished by firing rockets through the cloud altitude (82 km) at times when clouds are visible and again when they are not. The rocket nose section contains cans with different sampling surfaces. The sampling system is to be recovered by parachute.

(b) Direct measurement of energy and flux of electrons during an aural event using an electrostatic analyzer of the spherical type. Data are telemetered to the ground.

(c) Exposure of blocks of emulsions for detection and measurement of galactic cosmic radiation and low energy solar protons. The objective of this firing was the study of an auroral event in progress and a control for the noctilucent cloud experiment. No noctilucent clouds were visible. No tracking system capable of tracking the rocket throughout its trajectory is used. Optical tracking is used for the lowest part of the ascent. A recovery system using SARAH-receivers on the ground and in a helicopter operating together with a sound ranging system and surveillance radar is used.

2. LAUNCHING DATE: 7 AUGUST 1962

TIME: 004708Z
PEAK ALTITUDE: 105 km (est)
TELEMETRY SIGNAL: 376 sec

3. ROCKET PERFORMANCE: As predicted

4. INSTRUMENTATION PERFORMANCE: As predicted, with the C-6

exception that the parachute did not deploy and as a result there was no SARAH transmission. Information from one sound ranging station and from radar nevertheless enabled the helicopter crew to find and retrieve the nose cone.

5. PRELIMINARY EXPERIMENTAL RESULTS

(a) Noctilucent cloud sampling cans recovered vacuum sealed and intact, no quicklook data possible.

(b) Preliminary study of telemetry recordings shows detection of electrons with a peak of 27 keV from the highest parts of the trajectory.

(c) Due to hard landing, two corners of the nuclear emulsion pack were found broken. The opposite side may be salvageable. No quick look data was possible.

6. COMMENTS AND RECOMMENDATIONS

The parachute malfunction was possibly due to improper packaging, which was discovered in the recovery package at postflight inspection. Another possible cause is seam rupture in the recovery package due to separation at a comparatively low altitude, in an unfavorable drag regime, to attempt to get radar information on separation altitude. The action taken is to separate payload from the burnout second stage at a higher altitude to decrease g-values. Faulty parachute packaging is a random type failure and no corrective action is deemed warranted.

Reference: NASA REPORT OF SOUNDING ROCKET LAUNCHING

Vehicle: K62-2

Type: ARCAS

Launching Site: Kronogard, Sweden

Experimenter and Location:

Institute of Meteorology
University of Stockholm
Stockholm, Sweden

Project Manager: Lars Rey

Project Scientist: George Witt

1. OBJECTIVES AND INSTRUMENTATION

(a) Production of a cloud of particulate matter at Arcas separation altitude, approximately 70 km, to give information about light scattering properties of such a cloud, when illuminated by the sun under circumstances similar to those under which noctilucent clouds can be observed. The particle cloud was also aimed to give information about the winds at that altitude.

(b) The nose cone had a central core of high explosive surrounded by loosely packed dust of amorphous Mg O₂ and ignition devices.

(c) A pair of ballistic cameras at each end of a 15 km base line situated 140 km south of Kronogard at Kristineberg and theodolites at the same points were the only ground instrumentation.

Launching date: 7 August 1962

Time: 2202Z

Peak Altitude: 70 km (est)

Rocket Performance: As predicted

Instrumentation Performance: As predicted.

2. PRELIMINARY EXPERIMENTAL RESULTS

(a) The size and movement of the cloud produced can be reduced from the photos. It can be immediately said that the quantity of matter ejected was sufficient to produce a cloud visible for about 20 minutes in an unfavorable direction (scattering angle approximately 90°). The Kristineberg observation posts were able to see the cloud for at least 30 minutes thus indicating strong forward scattering. This fact, together with the observed bluish-white color and the polarization of the light from the cloud indicate that the size of the particles ejected were of the order of magnitude

of the wavelength of visible light. The total ejected mass and the volume of the cloud are expected to give information about the amount of particulate matter necessary to produce noctilucent clouds.

3. COMMENTS AND RECOMMENDATIONS

The results from this firing indicate the desirability of the continuation of this kind of firing, preferably with rockets capable of reaching a higher peak altitude.

Reference: NASA Report of Rocket Sounding Launching

Vehicle: K62-3

Type: Nike-Cajun

Launching Site: Kronogard, Sweden

Experimenters and Location:

Institute of Meteorology
University of Stockholm
Stockholm, Sweden

Kiruna Geophysical Observatory
Kiruna, Sweden

Geophysics Research Directorate
Bedford, Mass. USA

OBJECTIVES:

1. Direct sampling of noctilucent clouds for laboratory examination. (This is to be accomplished by firing rockets through the cloud altitude (82 km) at times when clouds are visible and again when they are not. The rocket nose section contains cans with different sampling surfaces. The sampling system is to be recovered by parachute.)
2. Direct measurement of energy and flux of electrons during an auroral event using an electrostatic analyzer of the spherical type. (The data is telemetered to the ground.)
3. Exposure of blocks of emulsions for detection and measurement of galactic cosmic radiation and low energy solar protons. The objective of this firing was the sampling of a visible display of noctilucent clouds and a control for the electrostatic analyzer experiment. The noctilucent cloud display was weak in intensity but wide-spread and confirmed and photographed by several observation posts. The Riometer at Kronogard and Kiruna showed no absorption and the Kiruna magnetometer indicated no activity of geomagnetic nature. Ground and helicopter tracking equipment were same as for K62-1.
4. Launching Date: 11 August 1962
5. Time: 014811 Z
6. Telemetry Signal: 915 seconds

7. Peak Altitude: 105 km (est)

8. Rocket Performance: Insofar as can be determined from flight times and accelerometer data, the rocket performance was as predicted but the impact had a 40-degree azimuthal deviation.

9. Instrumentation Performance: At Cajun burnout, the commutator which commutated one telemetry subcarrier and monitored payload functions ceased to operate. The magnetometer, which was on another continuous channel subcarrier frequency also ceased to operate at the same time. Both of these functions returned to normal at payload separation. Recovery indicated that all payload functions, were performed at approximately the present times. However, no attitude information is available during the time no magnetometer readings were received. Neither of the SARAH ground transmission antennas was ejected upon ground impact, causing loss of homing signal after impact. The SARAH-signal during the parachute descent together with the other recovery aids enabled the helicopter to find the payload 19 minutes after launch.

10. Preliminary Results:

- (a) The sampling cans appeared to be sealed and intact. No quick look data was possible.
- (b) Preliminary study of telemetry recordings shows positively no electrons detected. This indicates that the measurements from the earlier firings were real.
- (c) The emulsion packs were found intact and in good condition. No quick look data was possible.

11. Comments and Recommendations: The commutator and magnetometer trouble was undoubtedly due to a faulty contact in a stepping relay which misbehaved on two occasions prior to mating the payload. Since this relay appeared to operate properly in the final preflight payload check and because of the rarity of the noctilucent cloud event, the decision was made to fire despite the uncertain state of this relay. The only possible explanation for the malfunctioning SARAH ground transmission antennas that can be offered at present is a faulty pyrotechnic delay actuator which may have fired prematurely. No corrective action is deemed necessary.

Reference: Report by L. Rey, Kronogard, Sweden, dated
23 August 1962.

Vehicle No: K 62-4

Rocket Type: Nike Cajun

Launching Site: Kronogard, Sweden

Experimenters and Location:

Institute of Meteorology
University of Stockholm
Stockholm, Sweden

Kiruna Geophysical Observatory
Kiruna, Sweden

Geophysics Research Observatory
Bedford, Mass., USA

Project Manager: Lars Rey

Project Scientists: Johannes Ortner
George Witt

(Abstracted from a report by L. Rey, Kronogard, Sweden,
23 August 1962)

19 August 1962 005739 Z Peak Altitude 105 km (est)

Telemetry Signal 325 seconds

1. The objective of this firing was the sampling of a visible display of noctilucent clouds and a control for the electrostatic analyzer experiment.
2. Ground and helicopter tracking equipment were the same as for K62-1.
3. The instrumentation was successful up to the point where payload separation should have occurred. Failure of separation action prevented recovery functions.
4. All four explosive bolts were found. Two of the bolts did not show the normal severance pattern. The condition of the parts precludes blaming the failure positively on one or two of these bolts.
5. Comments and Recommendations:
 - (a) The noctilucent cloud display was weak in intensity.

It was observed from aircraft in the vicinity of the launching site and the observation post at Kristineberg as well as from the ground at those places. The cloud cover was apparently widespread as indicated by the fact that it subtended more than 100 degrees in azimuth and was visible from the aircraft up to 16 degrees elevation where it was obscured by the earth shadow. There was no reason to suspect that the cloud cover did not extend beyond zenith in the vicinity of Kronogard. Photographs of the clouds were obtained. Despite the weakness of the display and the limited observations, the decision was made to fire because of the period of the year during which noctilucent clouds previously have been observed was near its end.

(b) The sound ranging system localized the impact area and the vehicle was found two days later by the search helicopter.

(c) The sampling cans were found in a badly deformed state. A very slight possibility of salvaging one of the cans still exists.

(d) A preliminary look at the telemetry recordings indicates that the data were not similar to those of the previous measurements. A more detailed analysis of the recordings will be necessary.

(e) The emulsion pack was found to be completely unmanageable.

Reference: Firing 671.3

Vehicle No.: K62-5

Rocket Type: Nike Cajun

Launching Site: Kronogard, Sweden

31 August 1962 005607 Z Peak Altitude 105 km (est)

Telemetry 32350C

(Abstracted from L. Rey report dated 1 September 1962)

1. The objective of this firing was the study of an auroral event in progress and a control for the noctilucent cloud experiment. No noctilucent clouds were visible. Ground and helicopter equipment were the same as for K62-1.
2. The objective was not obtained.
3. Failure to achieve the objective was due to the following reasons:
 - (a) The electrostatic analyzer did not function.
 - (b) No payload separation occurred.
 - (c) Recovery package functions did not occur.
 - (d) Photomultiplier high voltage supply failed at Cajun ignition.
4. The payload separation failure is possibly due to the same failure as on a previous firing (K62-4), i.e., one of the four explosive bolts failed to sever.
5. Conclusions:
 - (a) As can be determined from the telemetry records, the mechanical operations of the noctilucent cloud sampling system and the nuclear emulsion pack performed as predicted.
 - (b) Telemetry indicated that the current was applied to the four explosive bolts. Failure of the bolts evidently was due to inherent defects if the current was high enough to cause ignition in normal circumstances.

(c) The sound ranging system localized the impact area with an accuracy of a few hundred meters.

(d) If found it is possible but not probable that some of the sampling data may be salvable.

(e) It is highly unlikely that the emulsion pack will be of any scientific value.